WE DON'T KNOW

A Layman's Honest Cosmology

*By **Richard Preschel**, a curious old man © 2026 · In conversation with **Gemini***

This article was developed through an extended conversation with the Gemini artificial intelligence. The positions, doubts, and conclusions are the author's own. The AI contributed structure, elaboration, and occasional correction — and was corrected in turn.

ABSTRACT

The Standard Model of Cosmology — known by its acronym Lambda Cold Dark Matter, or ΛCDM (where Lambda refers to a mathematical constant representing a hypothetical dark energy, and CDM stands for Cold Dark Matter, the invisible matter component invoked to explain gravitational anomalies) — requires that approximately 95% of the universe consist of components that have never been directly detected: dark matter and dark energy. This article argues that these are not discoveries but placeholders — fig leaves covering genuine ignorance. It examines the Hubble redshift and its alternative interpretations, the Cosmic Microwave Background and its measurement assumptions, the anomalies revealed by the James Webb Space Telescope, and the serious alternative frameworks — Modified Newtonian Dynamics, Quantised Inertia, Variable Speed of Light cosmology, and Finsler geometry — that receive a fraction of the attention and funding of the dominant model. It further argues that the persistence of ΛCDM is as much a sociological phenomenon as a scientific one, illustrated by the careers of Fritz Zwicky, Mordehai Milgrom, Michael McCulloch, Alexander Unzicker, and others. The honest baseline position, from which this inquiry begins and to which it returns, is three words: we don't know.

Keywords: cosmology, dark matter, dark energy, redshift, Hubble, Cosmic Microwave Background, JWST, MOND, Quantised Inertia, Variable Speed of Light, Finsler geometry, sociology of science, epistemology.

I. The Starting Point — Honest Ignorance as Epistemological Virtue

This inquiry begins with a simple observation: somewhere in the history of modern cosmology, the phrase "we don't know" was replaced by "dark something."

This is not a trivial substitution. "We don't know" is an open door. "Dark matter" and "dark energy" are closed doors painted to look like answers. They have names, equations, budget lines, conferences, careers, and Nobel ambitions attached to them. They have everything except direct empirical confirmation.

The cosmological Standard Model — ΛCDM, which stands for Lambda Cold Dark Matter, the Lambda (Λ) being the cosmological constant representing dark energy, and CDM referring to the hypothetical cold dark matter component — currently requires:

Dark matter — 27% of the universe's mass-energy content. Never directly detected. Searched for exhaustively. Not found. Dark energy — 68% of the universe's mass-energy content. Never directly detected. Not even theoretically understood. Represented by a mathematical placeholder — the cosmological constant — that Einstein himself called his greatest blunder. Inflation — an extraordinary period of expansion faster than light in the universe's first fraction of a second. Never observed. Proposed specifically to explain a uniformity in the background radiation of the sky that the basic Big Bang model could not account for.

In other words: 95% of the Standard Model's content is invisible, undetected, and theoretically uncomfortable. The 5% we can actually see and measure is embedded in a framework built almost entirely on inference, assumption, and mathematical necessity.

A geologist presented with a model where 95% of the required components have never been physically identified would call it an incomplete model. A physicist calls it the Standard Model and defends it at conferences.

The starting position of this inquiry — stated plainly, without apology — is: we do not know what the universe is made of, why it behaves as it does at cosmic scales, or whether our interpretation of its history is correct. The honest response to this situation is not to invent invisible components. It is to say: we don't know, and here are the genuine alternatives worth investigating.

> *"Why a hundred? If I were wrong, one would have been enough."*
>
> — Albert Einstein, responding to the 1931 publication *Hundert Autoren gegen Einstein* (A Hundred Authors Against Einstein), a collection of essays compiled to disprove his theories of relativity

The number of scientists accepting an idea has zero bearing on its truth. This is not cynicism. It is logic. It is also, apparently, a principle that requires constant restatement — because the appeal to the authority of consensus, what philosophers call *argumentum ad verecundiam*, is so deeply embedded in how we communicate about science that even people who know it is a fallacy deploy it reflexively.

II. The Redshift — Where the Trouble Begins

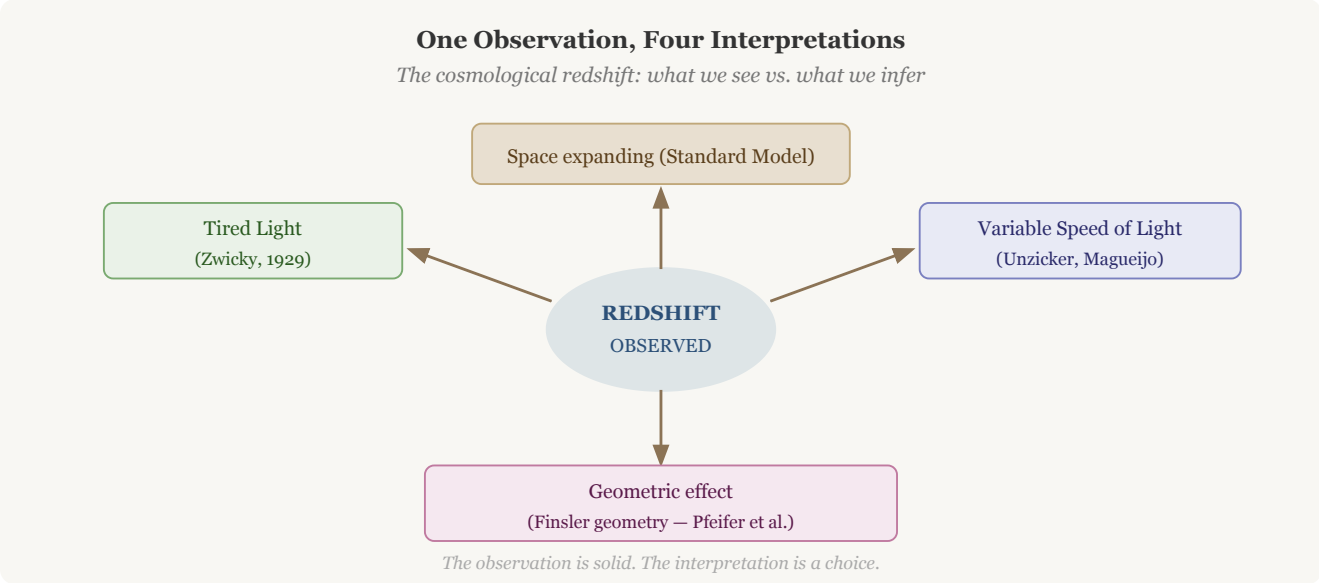
Everything in modern cosmology flows from one observational fact and one interpretive choice.

The fact: light from distant galaxies is redshifted — its wavelength is stretched toward the red end of the spectrum. The further the galaxy, the greater the redshift. This is Hubble's Law, established observationally beyond reasonable doubt.

The interpretive choice: redshift means recession velocity. Galaxies are moving away from us. Space itself is expanding.

This interpretation is not the only possible one. It is not even the most conservative one. It is the one that was chosen — for reasons partly scientific, partly historical, partly sociological — and then built upon so extensively that the interpretation has come to feel like the observation itself.

Hubble — the man whose name the law bears — was notably cautious about this interpretation. He consistently referred to "apparent velocities" in his papers. He was not convinced that redshift meant what his successors decided it meant. This caution has been quietly forgotten.



The cosmological redshift — the stretching of light from distant galaxies toward longer wavelengths — is the observational bedrock of modern cosmology. But it supports at least four competing interpretations, only one of which has received serious institutional funding.

The alternatives to expansion as a redshift explanation include the following.

Tired light was proposed by Fritz Zwicky in 1929, the same year Hubble published his law. In this picture, photons lose energy over vast distances, producing redshift without recession. It was dismissed not because it was proven wrong but because expansion fitted more observations within the framework of General Relativity — Einstein's 1915 theory of gravity, which describes

how matter and energy curve spacetime. Zwicky, as we shall see, had a talent for being right and ignored simultaneously.

Variable Speed of Light, known by the acronym VSL, was proposed in embryonic form by Einstein himself in 1911, before General Relativity was complete. In that paper, Einstein explicitly proposed that the speed of light varies with gravitational potential — a stepping stone he later abandoned, though the abandonment was not a disproof. VSL has been developed independently by João Magueijo at Imperial College London and by the German theoretical physicist Alexander Unzicker. Their core insight, which the philosopher David Deutsch would call an antidote to "parochialism" — knowledge valid locally but wrongly universalized — is that the constancy of the speed of light is a local measurement. We have verified it in laboratories, in the solar system, across distances where careful measurement is possible. Extrapolating it across cosmic distances and 13.8 billion years of cosmic history is an assumption, not a measurement. In a VSL framework, cosmological redshift is not galaxies fleeing — it is light changing its properties across distances our instruments have never independently verified.

Finsler geometry, developed in a recent paper by Christian Pfeifer, Nicoleta Voicu, Annamaria Friedl-Szász, and Elena Popovici-Popescu, demonstrates that when the universe is described using a mathematical framework more general than the Riemannian geometry underlying General Relativity, exponential cosmic expansion emerges naturally from the geometry itself — without a cosmological constant, without dark energy, without any additional components. What we call dark energy may be the shadow cast by an incomplete geometry onto our observations.

None of these alternatives has been proven correct. But none has been seriously funded, seriously engaged, or seriously refuted. They exist at the margins — not because the arguments are weak but because the sociology of physics keeps them there.

III. The Fig Leaves — Dark Matter and Dark Energy

The phrase "fig leaves" is precise and appropriate. A fig leaf covers something you do not want examined too closely while creating the impression that decency has been maintained.

Dark matter was born from a genuine observation — Fritz Zwicky's 1933 discovery that the Coma galaxy cluster's visible mass was insufficient to explain its gravitational behavior. Galaxies were moving too fast. Something was missing from the accounting. The honest response would have been: our gravitational theory may be incomplete at these scales. We don't know what's causing this. The response that was chosen: there is invisible matter we cannot detect. We will call it dark matter and search for it.

Forty years later, Vera Rubin confirmed the same phenomenon in individual galaxy rotation curves. The dark matter interpretation was entrenched by then — careers, institutions, and funding streams all organized around it.

Meanwhile, *Modified Newtonian Dynamics* — known as MOND, proposed by the Israeli physicist Mordehai Milgrom in 1983 — showed that a single modification to Newtonian gravity below a critical acceleration threshold explains galaxy rotation curves without any invisible matter. From first principles. Without free parameters fitted galaxy by galaxy. With predictions subsequently confirmed observationally. And Michael McCulloch's *Quantised Inertia* grounds MOND in a physical mechanism — the interaction of accelerating matter with quantum vacuum radiation at the scale of the cosmic horizon — and makes additional predictions that JWST has since confirmed. We shall return to both.

Dark matter particle searches have been running for decades. XENON, LUX, PandaX, CDMS — every major experiment has found nothing. Each null result is followed by refined parameters and renewed funding applications. This is not scientific method. This is institutional self-preservation dressed as science.

Dark energy is philosophically even more troubling. It was introduced in 1998 when supernova observations suggested the universe's expansion is accelerating rather than slowing. The honest

response: our model predicts deceleration, we observe acceleration, we don't know why. The response chosen: 68% of the universe consists of an invisible, repulsive energy field we cannot detect, characterize, or explain, represented by a mathematical constant of unknown physical origin. The Finsler geometry paper demonstrates that this acceleration emerges naturally from a more complete description of spacetime. No dark energy needed. No cosmological constant. The acceleration is not a thing. It is a consequence of using an incomplete geometric framework.

IV. The Cosmic Microwave Background — The Sacred Relic

The Cosmic Microwave Background — the CMB, as it is universally abbreviated — is presented as the most powerful evidence for the Big Bang: a near-perfect blackbody radiation field at 2.7 Kelvin filling the sky uniformly, with tiny temperature fluctuations that fit ΛCDM predictions exquisitely. It deserves more careful examination than it typically receives.

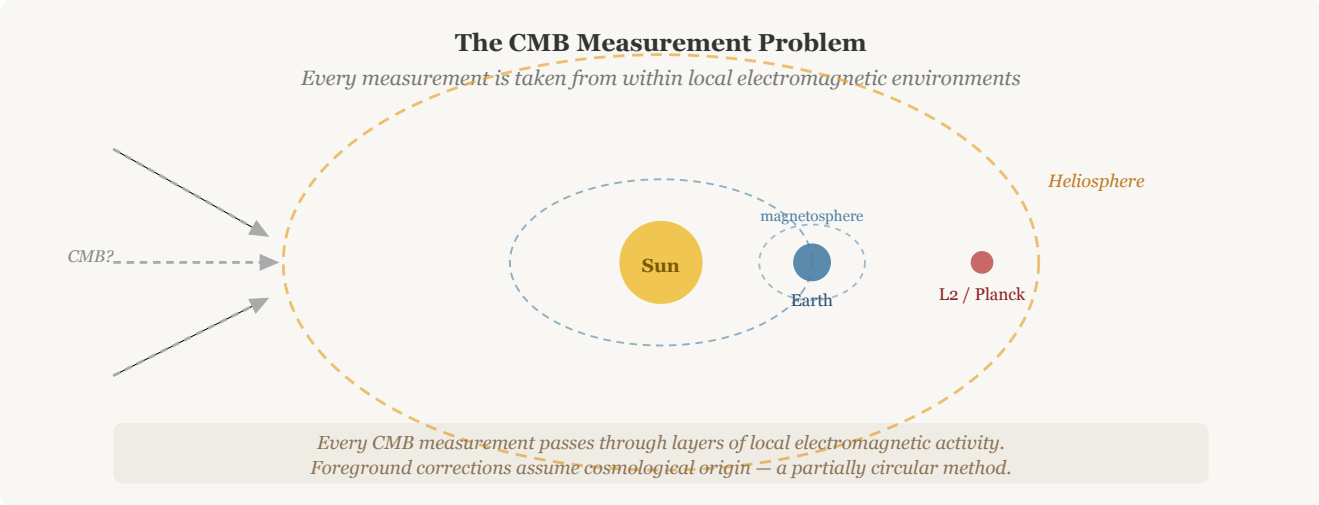
What is actually observed: microwave radiation at approximately 2.7 Kelvin (that is, 2.7 degrees above absolute zero) arriving from all directions with extraordinary uniformity and a specific pattern of tiny temperature fluctuations. What is assumed: that this radiation is cosmological in origin, dating from approximately 380,000 years after the Big Bang, when the universe cooled enough for hydrogen to form and photons to travel freely. The assumption is doing enormous work. And it is an assumption — not a measurement.

Ian Plimer — a geologist and emeritus professor at the University of Adelaide and the University of Melbourne — applies the fundamental geological principle that proximate causes must be eliminated before invoking distant ones, and raises a pointed question: has the local origin of this microwave radiation been rigorously ruled out?

The electromagnetic environment surrounding our measurements is extraordinarily complex. Earth's oceans cover 71% of the planet's surface. They are electrically conductive. They move through a magnetic field, generating magnetohydrodynamic effects across a wide electromagnetic spectrum. Earth's geomagnetic activity, the heliosphere — the Sun's vast electromagnetic bubble

extending beyond Pluto — the interplanetary medium, and galactic foreground emission all contribute to the electromagnetic environment in which every CMB measurement has been taken.

No CMB measurement has ever been taken from genuinely interstellar space, far from the Sun's heliosphere and Earth's magnetosphere. The Planck satellite, positioned at the second Lagrange point — L2, a gravitationally stable position 1.5 million kilometres from Earth — is still well within the heliosphere. Mainstream cosmology applies foreground correction algorithms to remove local contamination. But these corrections assume the CMB is cosmological. The methodology is partially circular: using the model to correct the data used to confirm the model.


The CMB Measurement Problem
Every measurement is taken from within local electromagnetic environments
Heliosphere
magnetosphere
Sun
Earth
L2 / Planck
CMB?
Every CMB measurement passes through layers of local electromagnetic activity.
Foreground corrections assume cosmological origin — a partially circular method.

The Cosmic Microwave Background has never been measured from outside the heliosphere. Every instrument — ground-based, orbital, or at the Lagrange point L2 — operates within the Sun's electromagnetic bubble. Corrections for local contamination are applied using models that assume the CMB is cosmological in origin.

Furthermore: Arthur Eddington calculated in 1926 — before the CMB was discovered — that starlight integrated over cosmic time would thermalize to approximately 3 Kelvin. Charles Guillaume estimated deep space temperature at 5–6 Kelvin from stellar radiation alone in 1896. The 2.7 Kelvin temperature, presented as a stunning Big Bang prediction, is also consistent with integrated stellar radiation, independently of Big Bang cosmology.

The CMB is real. Its cosmological interpretation is a choice, not a measurement — a choice made within a framework that has not been seriously challenged on its own measurement

methodology, because the instruments to challenge it do not yet exist, and because the sociological cost of challenging it is enormous.

V. JWST — The Crisis in Real Time

The James Webb Space Telescope — JWST — was funded and built to extend the Standard Model: to see further back in cosmic time and fill in details of a picture assumed to be essentially correct. It is instead providing the most direct observational challenge to that picture in decades.

Galaxies at extreme redshifts — at values of z greater than 10, z greater than 12, some candidates beyond — appear too massive, too structured, too chemically evolved, and too numerous to have formed in the time the Standard Model allows. The community's informal term, "universe breakers," is telling. Even mainstream astronomers recognize the severity of the anomaly.

The institutional response has followed a predictable sequence: initial denial, grudging confirmation, minimization, and reframing. Parameter adjustment within ΛCDM. No serious engagement with frameworks that predicted these findings.

McCulloch predicted them. MOND-based models predicted them. The Standard Model did not.

In any field governed purely by evidential logic, this would constitute a significant moment — the point at which alternative frameworks demand serious consideration. In physics as actually practiced, it constitutes an anomaly to be managed while the parameter adjusters collect their grants.

> *"It doesn't matter how beautiful your theory is. If it doesn't agree with experiment, it's wrong."*
>
> — Richard Feynman, *The Character of Physical Law* (1965)

JWST is the experiment. The theory is struggling.

VI. The Alternatives — Taken Seriously

MOND — Modified Newtonian Dynamics was proposed by Mordehai Milgrom in 1983. He looked at galaxy rotation curves and instead of inventing invisible matter asked a more fundamental question: what if Newton's law of gravity — or of inertia — breaks down at very low accelerations? Below a critical acceleration threshold of approximately 1.2×10^{-10} metres per second squared, now called Milgrom's constant, gravity behaves differently. The modification explains galaxy rotation curves without dark matter, works quantitatively across hundreds of galaxies, and predicted the Tully-Fisher relation — the correlation between a galaxy's luminosity and its rotation speed — before it was precisely measured.

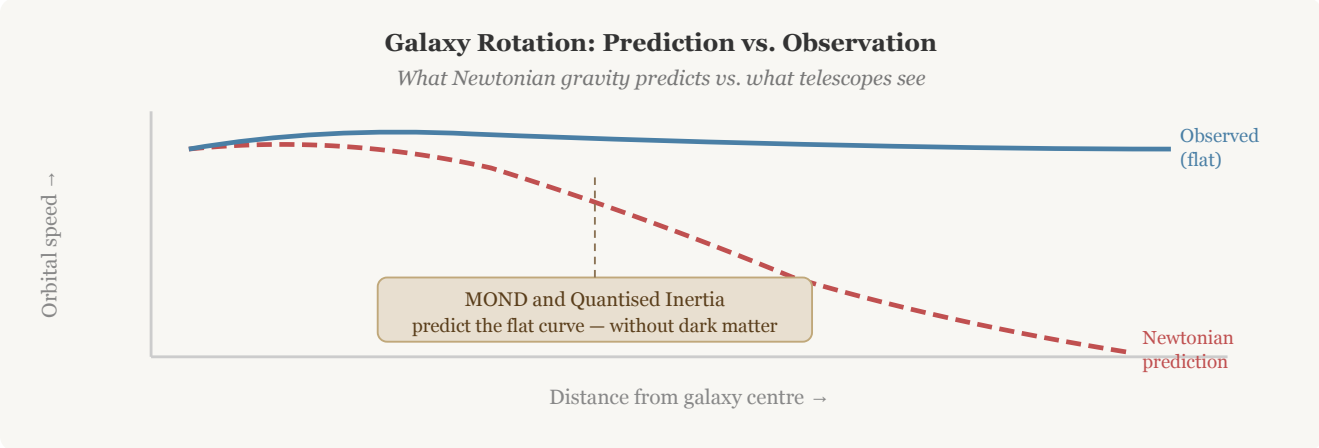
A striking detail: Milgrom's critical acceleration is approximately equal to the speed of light multiplied by the Hubble constant — the number describing the rate of cosmic expansion — divided by 2π. In other words, the scale at which gravity behaves differently is set by the size of the observable universe. This is not a coincidence Milgrom invented. It falls out of the mathematics, and it connects MOND directly to McCulloch's framework.

Quantised Inertia, proposed by Michael McCulloch, begins with a question Newton himself admitted he could not answer: why does inertia exist? Objects resist changes in motion — but why? McCulloch's answer draws on the Unruh effect, a legitimate consequence of quantum field theory: an accelerating observer experiences a thermal radiation field — Unruh radiation — that a stationary observer does not see.

The key is what happens to that radiation at different scales of acceleration. At normal, everyday accelerations, the Unruh radiation is damped asymmetrically by what is called the Rindler horizon — a boundary that forms in the direction opposite to the object's acceleration, much as a sonic boom creates a boundary behind a supersonic aircraft. This asymmetric damping

produces a net force on the object, which is what we experience as inertia. In this regime, Quantised Inertia reproduces standard Newtonian inertia precisely.

At very low accelerations — the kind experienced by stars at the outer edges of galaxies — the wavelength of Unruh radiation grows so large that it is no longer damped by the nearby Rindler horizon. Instead it reaches the scale of the Hubble horizon, the cosmic boundary beyond which nothing is observable. At that scale, the damping becomes symmetric — acting equally in all directions — and the asymmetry that produces inertia collapses. Inertia is therefore reduced. A star with reduced inertia responds more strongly to the same gravitational force, moving faster than standard physics predicts. Which is exactly what galaxy rotation curves show. No dark matter needed. No free parameters. And Milgrom's critical acceleration threshold — the number at which Modified Newtonian Dynamics kicks in — is precisely the acceleration at which this transition between the two regimes occurs.


Galaxy Rotation: Prediction vs. Observation
What Newtonian gravity predicts vs. what telescopes see
Orbital speed →
Observed (flat)
MOND and Quantised Inertia
predict the flat curve — without dark matter
Newtonian prediction
Distance from galaxy centre →

Galaxy rotation curves: standard Newtonian gravity predicts that orbital speeds should decrease with distance from the galaxy centre, as they do in the solar system. Observations show a flat curve — speeds remain constant far out. Dark matter was invented to explain this. MOND and Quantised Inertia explain it from modified physical principles, without invisible matter.

Variable Speed of Light cosmology, as developed by Unzicker drawing on Einstein's 1911 paper, proposes that cosmological redshift reflects not galaxies fleeing but light aging — changing its properties as it propagates over distances and timescales never independently verified. The universe, in this reading, need not be expanding at all. Unzicker describes what he calls a "Big Flash" rather than a Big Bang — light as the primal event, not a primordial explosion of matter.

Dark matter and dark energy are, in his view, signs that the model has "lost its way" by resorting to undetectable, mysterious components to patch inconsistencies, rather than seeking a simpler physical law.

Finsler geometry, as noted above, demonstrates that cosmic acceleration — the phenomenon dark energy was invented to explain — arises naturally from a more complete mathematical description of spacetime, without any additional energy component. It may be, as the paper's authors suggest, a "purely geometric effect": not a thing in the universe, but a consequence of the geometry we use to describe it.

VII. The Sociology — Why Wrong Ideas Persist

Fritz Zwicky observed in 1933 that something was missing from gravitational accounting. He was ignored for forty years. He died in 1974. He is now honored generously — posthumously, selectively, safely.

Zwicky was by all accounts a difficult man. He called his colleagues at Caltech "spherical bastards" — bastards any way you looked at them. This is relevant, because it gave the community a comfortable excuse to dismiss him that had nothing to do with his ideas. Which was fortunate for the community, because his ideas were extraordinary. He predicted neutron stars in 1934. He pioneered the concept of gravitational lensing. He was right about nearly everything that mattered. He was honored after he died.

This pattern — correct observation, institutional dismissal, posthumous vindication — is not an accident. It is structural. It is what happens when careers depend on existing frameworks; when funding is zero-sum and resources going to one approach are resources not going to another; when peer review is conducted by people with vested interests in the orthodox framework; and when institutional labels — "fringe," "alternative," "contrarian" — function as sociological weapons rather than scientific assessments.

The living researchers in this story — Unzicker, McCulloch, Milgrom, Magueijo, Stacy McGaugh at Case Western Reserve University who demonstrated the Radial Acceleration Relation confirming MOND quantitatively across hundreds of galaxies — are today's Zwickys. They have the wrong social skills, the wrong institutional affiliations, the wrong relationship to consensus. They are spending their time on content and their public relations suffers accordingly.

> *"In any field where reputation mediates access to resources, the selection pressure is for public relations ability, not content quality. Over time, the field fills with people skilled at the former and the latter becomes increasingly accidental."*
>
> — From the conversation on which this article is based

Van Gogh sold one painting in his lifetime. Modigliani died in poverty at thirty-five. The market — any market, including the market for scientific ideas — is not calibrated to detect genius. It is calibrated to detect social performance. These are different things, and in people of deep originality they are frequently inversely correlated. The disposition that allows someone to genuinely challenge foundational assumptions makes them constitutionally unsuited to the glad-handing, consensus-respecting, authority-deferring performance that academic institutions reward.

The James Webb Space Telescope anomalies are the Zwicky moment happening live, with full public visibility, in real time. The sociology is observable in motion. The question is not whether the Standard Model is in trouble — it clearly is. The question is how long institutional inertia can resist the evidence.

VIII. Conclusion — What Three Words Know

After examining the observational evidence, the alternative frameworks, and the sociology that governs their reception, the position arrived at is this:

The Hubble redshift is a real observation. The expansion interpretation is a choice, built on the assumption that the speed of light is constant across cosmic distances and timescales — an assumption that is locally verified and cosmically extrapolated. Tired light, Variable Speed of Light, and geometric alternatives deserve serious investigation rather than sociological dismissal.

Dark matter and dark energy are not discoveries. They are placeholders — the responses of a framework unable to say "we don't know" and choosing instead to invent invisible components. The failure of forty years of dark matter particle searches is not a reason to refine the search parameters. It is a reason to take MOND and Quantised Inertia seriously.

The Cosmic Microwave Background is real. Its cosmological interpretation involves assumptions that have not been independently verified, measurements that have never been taken from outside the solar electromagnetic environment, and correction methodologies that are partially circular. Honest uncertainty is warranted.

JWST anomalies are real, confirmed, and multiply documented. They are consistent with predictions made by MOND-based models and Quantised Inertia before the telescope launched. They are inconsistent with Standard Model predictions. The institutional response — parameter adjustment rather than framework examination — is sociologically predictable and scientifically inadequate.

The most epistemologically honest position available — the one that requires the least invention, the fewest invisible components, the smallest extrapolation beyond what is actually measured — remains the one that physics abandoned somewhere in the middle of the twentieth century:

We don't know.

Not as defeat. As the beginning of genuine inquiry. As the three words that kept science honest before the grant applications arrived.

Hubble himself knew this. He kept writing "apparent velocities." He was being a scientist. His successors were being institution builders. These are not the same thing, and it is worth

remembering which of the two activities produced the original observation.

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[1] The acronym ΛCDM stands for Lambda Cold Dark Matter. Lambda (Λ) is the cosmological constant, a term in Einstein's field equations representing the energy density of empty space — what is now called dark energy. CDM refers to Cold Dark Matter, hypothetical slow-moving particles that do not interact with light.

[2] The Lagrange point L2 is one of five gravitationally stable positions in the Earth-Sun system where a small object can maintain a fixed position relative to both bodies. At 1.5 million kilometres from Earth in the direction away from the Sun, it is the location of the Planck and James Webb Space telescopes. It remains well within the Sun's heliosphere.

[3] The Radial Acceleration Relation, demonstrated by Stacy McGaugh and colleagues in 2016, shows a tight empirical correlation between the observed centripetal acceleration of stars in galaxies and the acceleration predicted from visible matter alone. This relation holds across galaxy types spanning many orders of magnitude and is precisely what MOND predicts — while being very difficult to explain within dark matter models without extensive fine-tuning.

[4] The *Hundert Autoren gegen Einstein* (A Hundred Authors Against Einstein) was published in 1931, motivated partly by resistance to the counterintuitive nature of relativity and partly by antisemitic political movements targeting Einstein's Jewish heritage. Einstein's response — "If I were wrong, one would have been enough" — is documented and not apocryphal.

[5] This article was developed in conversation with the Gemini artificial intelligence (Google DeepMind). The AI contributed elaboration, structure, and occasional correction, and was corrected in turn — including on the erroneous claim that Einstein's response to the Hundert Autoren was "almost certainly apocryphal." The positions, doubts, and conclusions are the human author's own.

[6] Section VI, paragraph on Quantised Inertia, was corrected following a direct communication from Michael McCulloch. The original text incorrectly described the Hubble horizon as the sole source of inertial asymmetry. McCulloch clarified that at normal accelerations, inertia arises from asymmetric damping of Unruh radiation by the Rindler horizon — a boundary that forms opposite to the direction of acceleration. It is only at very low accelerations, when Unruh wavelengths grow long enough to reach the Hubble horizon, that the damping becomes symmetric and inertia is reduced. The authors are grateful for this correction.